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Assessment of Nutritional Status by Composite Index of Anthropometric Failure (CIAF): A Study among under-5 Children in Chennai, Tamil Nadu, India.

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ABSTRACT

India is one of the countries with the highest burden of under nutrition among the under 5 children. To assess the overall prevalence of under nutrition using Composite Index of Anthropometric Failure (CIAF) and to compare it with the three conventional indices namely underweight, stunting and wasting. This cross sectional community based survey was conducted among the under five children from the urban slums of Egmore, Chennai. WHO Anthro software (version 3.2.2) was used to calculate the Z scores for the above three indices. The same data was used to construct CIAF. A total of 357 children aged one month to 5 years were enrolled in this study. CIAF showed a higher prevalence of under nutrition 37 % (95% CI 32.1%-42.1%) in comparison to the standard anthropometric indices namely underweight at 19.3%, stunting at 16.8% and wasting at 21.8%. The difference in the prevalence of anthropometric failure in different age groups was found to be statistically significant (p = 0.002). We found that 37% of the under 5 children were in a state of Anthropometric Failure. CIAF will prove to be a valuable tool for the physicians and policy makers in planning and monitoring National Health Programs.

Keywords: Under nutrition, Composite Index of Anthropometric Failure, CIAF, Anthropometry, Under five children

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INTRODUCTION

India is one of the countries with the highest burden of under nutrition among the under 5 children [1]. Globally, under nutrition is the cause of 45% or 3.1 million child deaths annually [2]. As per the UNICEF, the under-5 mortality rate is the best single indicator of social development rather than the gross national product per capita, as it reflects the income, nutrition and basic education of the family [3]. The National Family Health Survey (NFHS)-4, 2015-16 data showed that in India the rates of under nutrition for children younger than five years of age were 35.7% for underweight, 38.4 % for stunting and 21 % for wasting [4]. Long term effects of under nutrition in young children span into their future and also into the future generations. These children are more likely to become short adults with lower educational achievement and lower economic status and give birth to smaller infants [5]. The three most commonly used anthropometric indicators of under nutrition are stunting, wasting and underweight. The current WHO recommendation is to use the Z-score to grade under nutrition. This allows us to measure all the above three indices in terms of Z scores or standard deviation units from the median of the international reference population [6]. Shunting reflects chronic under nutrition, wasting describes acute under nutrition whereas underweight takes into account both acute and chronic under nutrition [7]. In the year 2000 a Swedish Economist Svedberg suggested an alternative measure to assess the overall prevalence of under nutrition – Composite Index of Anthropometric Failure [8]. To provide a comprehensive measure of the overall prevalence of under nutrition as a single indicator, Svedberg and Nandy et al used the above 3 indicators to construct the Composite Index of Anthropometric Failure (CIAF). This identifies seven groups of children including those without any form of anthropometric failure [9]. Since there is still a paucity of community based studies on childhood under nutrition using the new model-Composite Index of Anthropometric Failure (CIAF) in India, we conducted the present study to assess the overall prevalence of under nutrition using CIAF and compared it with the three conventional indices.

METHODS

A community-based cross-sectional study was conducted during the January to March 2015 in the urban slums of Egmore, Chennai. The sample size of 357 children was calculated based on the 35.7% prevalence of underweight among under five children in India as reported by the National Family Health Survey-4 (NFHS) [4]. The parents / guardian were informed about the study and their consent was obtained. Clinical examination and nutritional assessment were done. The anthropometric measurements namely weight and height were taken for each child. Weight was measured to the nearest 100 grams using a portable electronic weighing machine after removing heavy clothing, footwear and other accessories. The length was measured with an infantometer, the height with a stadiometer to the nearest 0.1 cm. Internationally accepted the WHO child growth standards (2006) age and sex specific – 2 z-scores were followed to define underweight, stunting and wasting [10,11]. The WHO Anthro software (version 3.2.2) was used to calculate the Z scores. Rates of stunting, wasting and underweight were calculated. The same data was used to construct the CIAF. This classification is fully defined in Table 1. The CIAF excludes those children who are not in anthropometric failure (i.e. group A) and counts all the children who are underweight, stunted or wasted (i.e. groups B through Y).

Analysis

Data entry and analysis were done using SPSS version 16. Prevalence of anthropometric failure and the 95% confidence interval (C.I) were calculated. The association between demographic variables and anthropometric failure was estimated by chi-square test. A p value of < 0.05 was considered as statistically significant.

RESULTS

A total of 357 children aged one month to 5 years were enrolled in this study. Among them 52.7 % were males. The mean age of the children was 38.13 months, with a range from 1 month to 60 months. Prevalence of under nutrition based on the Z score system were as follows: Totally 71 (19.9%) children were underweight and out of them 25(7%) were severely underweight. Totally 77 (21.6) children were wasted and out of them 37(10.4%) were severely wasted. Totally 60 (16.8%) children were stunted and out of them 16 (4.5%) were severely stunted.

Prevalence of under nutrition based on the CIAF index is shown in Table 2. The proportion of children in each of the subgroup is shown in Table 3. Of the seven subgroups with undernourished children, group B (containing children who are wasted) is the largest 35 (9.8%). Children who were simultaneously wasted, stunted and underweight (i.e. those in group D) account for 10 (2.8%) of the children.

According to the CIAF index we found that out of the 357 under 5 children studied, 225 (63%) children were normal; the prevalence of Anthropometric Failure was found to be 37% with the 95% confidence interval from 32.1% to 42.1%. The prevalence of under nutrition was higher as per the CIAF index when compared to Z score system. According to the WHO Z- score system, 69 (19.3%) children were underweight, 60 (16.8%) were stunted and 78 (21.8%) had wasting.

The Association between Demographic Variables and Anthropometric Failure is given in Table 4. The prevalence of anthropometric failure among males and females were 37.2% and 36.7% respectively. The difference in the prevalence of anthropometric failure among male and female children was small and this difference was not found to be statistically significant (p= 0.91). Children in the age group 25-36 months had the highest prevalence of anthropometric failure to the extent of 50 % followed by the age group 37-48 months and 13-24 months. The age group 49 months and above had the lowest prevalence. The difference in the prevalence of anthropometric failure in different age groups was found to be statistically significant (p = 0.002).

DISCUSSION

In this paper it has been shown that the CIAF can be constructed to provide a single aggregated figure of the number of undernourished children in the community. We studied 357 children and found that CIAF showed a higher prevalence of under nutrition at 37 % in comparison to other three indicators namely underweight, stunting and wasting. In our study, according to the WHO Z-score system, 69 (19.3%) children were underweight, 60 (16.8%) were stunted and 78 (21.8%) had wasting.

In India, Nandy *et al* was the first to use the concept of CIAF on the National Family Health Survey – 2 (NFHS - 2) data and applied it on 24, 396 children. They found that 45% of children were stunted, 47% were underweight and 16% had wasting. They also found that CIAF showed a higher prevalence of under nutrition, with 60% of children suffering from anthropometric failure [9]. Seetharaman et al conducted a study among the under 5 children of the slum population in Coimbatore [12]. They had also reported that CIAF showed a higher prevalence of under nutrition at 68.6% compared to the standard anthropometric indices namely underweight (49.6%), stunting (48.4%) and wasting (20.2%). Mandal et al assessed the overall prevalence of under nutrition using composite index of anthropometric failure (CIAF) among preschool children attending the ICDS center in the Hooghly District of West Bengal. They found that 26.6%, 50.0% and 63.3% were stunted, wasted and under weight, respectively whereas CIAF showed a higher prevalence of under nutrition of 73.1% [13]. Similar observations were made by Savanur et al in the slums of Mumbai city and they found the prevalence of underweight, stunting and wasting was 35.7 %, 33.8 % and 18.5 % respectively. As per CIAF, 47.8 % children were undernourished [14]. Similar observations were made in studies from Chhattisgarh by Boregowda et al and from Ahmadabad by Solanki et al, though the prevalence rates of under nutrition were higher than found in our study [15,16]. Bejarano et al assessed CIAF in the child population settled at different altitudinal zones in Jujuy, Argentine. They included a total of 8059 children and found the CIAF for highland children to be 6.1% and it was double that for lowland children at 3.4% [17].

Nandy et al have applied the CIAF calculation to 46,784 children aged 0–35 months in seven developing countries and found the difference between the CIAF and underweight was more than 10% they reported that CIAF provides an unequivocal statement on the degree of change in under nutrition over a period of time [18,19]. When we use underweight as the sole criterion for identifying under nutrition, in the present study, we would be including only 19.3 % children from subgroups C, D, E and Y, and will be missing out 10.9 % of the children in subgroups B and F children who were stunted / wasted but not underweight as not undernourished.

The difference in the prevalence of anthropometric failure among male and female children was small and this difference was not found to be statistically significant (p= 0.91). This is in concurrence with the study

done by Shit et al [20]. The difference in the prevalence of anthropometric failure in different age groups was found to be statistically significant (p = 0.002). Similar observations were made by Dasgupta et al [21].

The strength of the present study is that this is the first study to have used composite index of anthropometric failure-CIAF to estimate the overall prevalence of under nutrition in Chennai. Also, the study compares the prevalence rates of CIAF with all the conventional indices as assessed by the current WHO Z-score system. The limitation of our study was that all sections of the population should have been included.

CONCLUSION

We found that 132 (37%) of the under 5 children were in a state of Anthropometric Failure. This is a serious problem that needs attention. A comprehensive measure of the total burden of under nutrition such as the use of the Composite Index of Anthropometric Failure as discussed in this paper must be incorporated in our studies at quantifying under nutrition. Though the three conventional indices reflect distinct biological processes and are useful in clinical practice, the CIAF merits further consideration as a valuable tool for the physicians and policy makers in planning, monitoring and evaluating National Health Programs.

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